IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: Jonathan Shekter	Art Unit	: 2628
Serial No.	: 10/080,525	Examiner	: Peter-Anthony Pappas
Filed	: February 21, 2002	Conf. No.	: 8647
Title	: COMPOSITE RENDERING 3-D GRAPHICAL OBJECTS		

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REPLY TO ACTION OF AUGUST 10, 2006

In reply to the Final Office Action of August 10, 2006, Applicant submits the following remarks.

Claims 6-45 are pending in the application. Claims 34, 37 and 39 have been allowed. Claims 6-12,15-16, 18, 22-24, 26-33, 35-36, 38 and 42-44 stand rejected as obvious in view of U.S. Patent No. 5,990,904 ("Griffin"), U.S. Patent No. 5,809,210 ("Pearce"), and U.S. Patent Publication No. 2002/0097241 ("McCormack"). Claims 13, 20-21, and 40-41 stand rejected as obvious in view of Griffin, Pearce, McCormack and U.S. Patent No. 6,426,755 ("Deering"). Claims 25 and 45 stand rejected as obvious in view of Griffin, Pearce, McCormack and the text *Computer Graphics: Principles and Practice* ("Foley"). Claims 14, 17 and 19 stand as objected to, presumably because they depend from rejected claims 13, 16 and 18, respectively. The Applicant respectfully traverses these rejections, and requests reconsideration of claims 6-33, 35-36, 38 and 40-45 for the reasons noted below.

The application discloses "a 3-D image compositing system that allows 3-D objects to be separately rendered and combined together in a realistic-looking composite image or scene having all of the image processing effects that add realism to the scene such as anti-aliasing, motion-blur, and depth of field effects." *Application* at 2:9-12.[1] The disclosed image compositing system improves over prior art image compositing systems, which, while "allow[ing] a 3-D scene to be rendered with combined anti-aliasing, motion-blur, and depth-of-

[1] Notation of the form X:Y-Z refer to page X, lines Y-Z when reference is made to the application, and to column X, lines Y-Z when reference is made to a patent.

field effects, *require* the individual components of the scene to be *rendered together in the same rendering step*." *Id.* at 1:15-18 (emphasis added). Thus, prior art image compositing systems do not allow individual objects or components to be taken out of a scene once the scene has been rendered. Nor do they allow new objects or components to be added to the scene once the scene has been rendered. Instead, to add objects to or remove objects from a scene that has been rendered, prior art image compositing systems must re-render the entire scene, including all of the objects intended to be in the scene.

By contrast, the image compositing system disclosed in the application "allow[s] images and objects from different sources [and] made at different times to be seamlessly integrated into arbitrary composite scenes." *Id.* at 1:22-23. It also "allow[s] objects easily to be added and removed from a scene without having to re-render the entire scene" and "allow[s] for objects to be separately created, rendered, and realistically used and re-used in a multitude of different scenes." *Id.* at 1:23-27. The disclosed image compositing systems allows all of these functions because it first renders a 3-D object's primitives "to a motion buffer or M-buffer," which can be subsequently resolved to add its contents to an output buffer or scene. *Id.* at 4:16-19. To anti-alias and depth-of-field blur two objects rendered to and stored in an M-buffer, particularly when those two objects intersect, "information about the surface geometry of the intersecting objects" is be stored in the M-buffer. *Id.* at 8:20-22; 14:21-23. To motion-blur two objects rendered to and stored in an M-buffer, "the *z*-component of velocity or *dz/dt* of each object" is be stored in the M-buffer.

Rendered object data that has been stored in an M-buffer can be added to rendered object data that has been stored in a different M-buffer, and when the resulting M-buffer is resolved, the objects in the combined M-buffer will be combined in a scene with full anti-aliasing, motion-blur, and depth of field effects. *Id.* at 16:24-25. Similarly, rendered object data that has been stored in an M-buffer with other rendered object data can be removed from the M-buffer, and when the remaining contents of the M-buffer are resolved, the objects whose data remains in the M-buffer will be composited in a scene with full anti-aliasing, motion-blur, and depth of field effects.

Claims 6-8 and 26-28 respectively recite methods and computer programs for creating M-buffers or motion buffers to store the local properties of scan-converted 3-D objects. As explained above, these motion buffers are needed in order to be able to combine, add, and remove individual 3-D objects that are composited to a 2-D scene without having to re-render the entire scene. The claimed methods work, in part, by creating motion buffers that store a scan-converted 3-D object "rate of change of depth with time." Similarly, claims 9-21, and 29-33, 35-36, 38 and 40-41 respectively recite methods and computer programs for compositing scan-converted 3-D objects to a 2-D scene. The claimed methods work, in part, by receiving and processing motion buffers that contain the local properties of scan-converted 3-D object primitives, including the object primitives "rate of change of depth with time." Likewise, claims 22-25 and 42-45 recite methods and computer programs for rendering scan-converted 3-D objects to a 2-D scene. The claimed methods work, in part, by rendering motion buffers that contain the stored local properties of scan-converted 3-D object primitives, including the 3-D object primitives "rate of change of depth with time."

In rejecting each of claims 6-13, 15-16, 18, 20-33, 35-36, 38, and 40- 45 as obvious, the Examiner admits that the principle reference Griffin "fails to explicitly teach rate of change of depth with time." *Office Action* at 4. Instead, the Examiner relies on Pearce "to teach a rate of change of depth with time in a system for motion blur, wherein said motion blur is performed at least in part based on pixel (i.e., sampling point) information which is stored in memory (column 1, lines 12-19; column 6, lines 42-57; column 3, lines 49-58; Fig. 11)." *Id.* at 13. The applicant respectfully disagrees that Pearce teaches or discloses calculating, let alone storing, the "rate of change of depth with time" limitation recited in claims 6-13, 15-16, 18, 20-33, 35-36, 38, and 40-45.

Pearce teaches simulating a 3-D object's motion blur while rendering the object. Pearce does this by "analyzing the movement of tessellated representations of surfaces relative to a stationary sampling point on a pixel." *Pearce* at 1:45-48. Pearce's motion-blur method begins by first "identifying the intersections between the leading and trailing edges of . . . individual polygon[s] with the stationary sampling point. These intersection points define the boundaries of segments that indicate the *sub-interval of exposure time* where the sampling point is inside the polygon." *Id.* at 1:53-55 (emphasis added). These exposure time sub-intervals are then used to

group the surfaces of one or more 3-D objects together "based upon the continuity of time coverage." *Id.* at 2:5-6. The one or more sub-interval groups are then combined together "based upon the time coverages of each of the groups." *Id.* at 2:33-35. Thus, Pearce teaches calculating the motion blur of 3-D objects by rendering the objects together in a single step and calculating their pixel coverage information during that step. Pearce fails to disclose rendering the objects to an M-buffer or any other buffer or memory, in part by first calculating and then storing the objects "rate of change of depth with time" information as the Examiner contends.

The Applicant pointed out this important difference between Pearce and the claimed invention in response to the previous Office Action. The Examiner responded to that argument by admonishing the Applicant that it is improper to attack references individually when the rejections are based on combinations of references. *Office Action* at 13. But the Examiner relies *solely* on the Pearce reference to disclose the limitation of calculating and storing the "rate of change of depth with time" limitation. As explained above, the Examiner admits this limitation is missing from the primary Griffin reference. The only reference the Examiner alleges discloses this limitation is Pearce at 1:12-19; 3:49-58; 6:42-57; and Fig. 11. *Id.* at 13. The Applicant respectfully disagrees that Pearce discloses this limitation – either in the portions indicated by the Examiner, or in any other portions. Consequently, the Examiner has failed to establish a *prima facie* case of obviousness. The applicant notes that it is the "examiner [who] bears the initial burden, on review of the prior art or on any other ground, of presenting a *prima facie* case of unpatentability. . . . If examination at the initial stage does not produce a *prima facie* case of unpatentability, then without more the applicant is entitled to grant of the patent." *In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992).

Pearce, in the passage the Examiner relies upon at 1:12-19 merely states that when a viewer sees a sequence of images, each of which *has already been* motion blurred, the viewer perceives the motion of the objects in the images *because* of the blurriness. While this passage thus discloses the effect to be produced – blurriness – it fails to disclose how that effect is created. It certainly doesn't suggest or disclose that the effect is created or achieved by calculating and storing a 3-D object's rate of change of depth with time in a motion buffer or any other type of memory or buffer.

Nor does the Pearce passage at 3:49-58, which the Examiner also incorrectly relies, disclose the limitation of storing the "rate of change of depth with time" limitation. To understand the Pearce passage at 3:49-58, it is necessary to understand the preceding passage at 3:40-48. That passage indicates that "the display of object movements between the S_{open} and S_{closed} positions is the simulation of real-world motion blur." *Id.* at 3:40-48. But, rather than disclosing the simulation of motion-blur by calculating and storing an object primitive's "rate of change of depth with time," Pearce discloses the simulation of motion blur by calculating "the geometric coverage of a screen sampling point by a moving polygon." *Id.* In the next passage, which the Examiner relies upon to disclose the simulation of motion-blur by calculating and storing an object primitive's "rate of change of depth with time," Pearce instead merely discloses that because "[a] pixel can have more than one screen sampling point," the geometric coverage of a pixel can be calculating from a plurality of sampling points rather than a single sampling point. *Id.* at 3:49-58. Notably, however, Pearce fails to disclose storing a 3-D object's "rate of change of depth with time" as the Examiner alleges, or using that information to simulate the object's motion blur.

In the passage at 6:42-57, which the Examiner also relies upon, Pearce discusses the "dynamics" of a sorting process that is actually performed in step 502 of Figure 5. *Id.* at 6:32-43. The sorting process is based "upon the times of sampling point intersection and the depth of the polygon that produced the segment." *Id.* at 6:28-29. This is shown in Figure 6. As the Examiner correctly notes, Figure 6 is a graph having a *z*-axis and a *t*-axis. The graph contains a plurality of line segments that "are generated based upon the intersection of leading and/or trailing edges with a stationary sampling point." *Id.* at 6:49-51. While Figure 6 and its discussion at 6:42-57 thus disclose plotting the *z* or depth of a segment at a time *t* that it intersects a pixel sampling point, it fails to disclose calculating or storing the *dz/dt* or rate of change of depth with time of the segment, or using that information for any purpose, let alone for determining the motion blur of an object. Instead, the sorting process disclosed in Figure 6 is used merely to determine a list of visible object surfaces, and the relative amount of time that the visible object surfaces on the list cover a pixel sampling point. This is shown, for example, in Table 1 at 8:5-14. *Id.* at 7:61-65.

Finally, the Examiner relies on Figure 11 of Pearce for allegedly disclosing calculating and storing the "rate of change of depth with time" limitation recited in all of the rejected claims. But Figure 11 is merely "a block diagram of a computer useful for implementing elements of the present invention." *Id.* at 2:64-65. While the computer system shown in Figure 11 does have a memory where computer programs and other information can be stored, nothing in Figure 11 or the discussion of Figure 11 indicates that a scan-converted 3-D object primitive's "rate of change of depth with time" information is stored in the memory. Nor, as explained above, does any other passage in Pearce disclose calculating this information, let alone storing it for any purpose. Nor do any of the other references cited by the Examiner disclose this limitation. Consequently, the Examiner has failed to establish a prima facie case that any of claims 6-13, 15-16, 18, 20-33, 35-36, 38, and 40- 45 are obvious, and the claims should be allowed to issue for at least this reason. *In re Oetiker*, 977 F.2d at 1445 (Fed. Cir. 1992).

No fees are believed due; however, please apply any applicable charges or credits to deposit account 061050.

Respectfully submitted,

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